ACTIVE ALERTED POSTURE

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By

W E TUCKER

CVO, MBE, TD, MA, MB, BCh, FRCS

Consulting Orthopaedic Surgeon Royal London Homoeopathic Hospital Consulting Orthopaedic Surgeon, Horsham and Dorking Hospitals Hunterian Professor Royal College of Surgeons 1958 Formerly Registrar Royal National Orthopaedic Hospital Surgeon, St. John's Hospital Lewisham Orthopaedic Surgeon, St. John's Clinic and St. Stephen's Hospital, Fulham Orthopaedic Surgeon Erith Hospital Orthopaedic Specialist and Commanding Officer 17th General Hospital T.A.

Foreword by

Sir ARTHUR PORRITT

KCMG KCVO, CBE, LL D (Hon), M A., M Ch., F R C.S

Sergeant surgeon to Her Majesty The Queen
Surgeon St Mary's Hospital and Royal Masonic
Hospital London.



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TO

MY WIFE

FOREWORD

In to day's complicated and mechanised world, it is salutary occasionally to remember simple things When these things are simply described and simply explained, it is even more stimulating Such a subject is human posture—man's essential difference from the animals—and in this little monograph Mr Tucker discusses posture—its nature, its varieties and the implications it has in both natural and pathological states, in the straightforward and practical manner to be expected from one with such wide knowledge of sports and occupational injuries, of orthopaedic surgery and of the physical methods of therapy and rehabilitation

Whatever may be one's personal interpretation of the facts he adduces, his theory must offer a challenge not only to the medical profession—to which his thesis is primarily addressed—but also to educational authorities, physical instructors and sports coaches and trainers

London, 1960 ARTHUR PORRITT

PREFACE

The problems associated with stress and strain are exercising the minds of many members of the medical profession It would seem evident to me that in the individual who slumps, strain is primarily thrown on the postural muscles and in time on the joints which these muscles are intended to support It would appear that one of the most important factors in the causation of muscular rheumatism and so called fibrositis is postural strain

As the effects of strain progress so the articular cartilages become worn with the onset of osteoarthritis This is associated with disc degeneration and neuritis in the case of the spine, and osteoarthritis in weight bearing joints

This monograph is intended chiefly for the general practitioner because, through him, the benefits of Active Alerted Posture can be more widely extended, and for the physiotherapist who is constantly treating the effects of poor posture It would also seem to me, nevertheless, that Active Alerted Posture should be a *sine qua non* of all orthopaedic work Before any operative procedure is contemplated for arthrodesing weak joints, attempts should first be made to teach the patient how to stabilise them himself by fixing and locking the joints at the various prime fixing levels before starting an action

I have had valuable assistance in this attempt to formulate *the problems connected with Active Alerted Posture especially* from my wife, Molly Castle, from the late Dr Stannus, Dr Pether, Dr J Martin, Dr R P Goulden, Dr Geraint James, Dr J G Bearn and Mr Gabriel Costa

I am indebted to Mrs Audrey Besterman for the excellent illustrations

I should like to express my appreciation to Sir Arthur Porritt for his generous foreword

Finally I am greatly indebted to my publishers, Messrs E & S Livingstone Ltd , and particularly to Mr Charles Macmillan and Mr William McMillan, for assistance and advice

London, 1960 W E TUCKER

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CHAPTER I

THE CLASSIFICATION OF POSTURE
SKELETAL TYPES AND POSTURAL ATTITUDES
MOBILE SECTIONS AND FIXED STABLE LEVELS

Most people are inclined to accept posture as a natural and not particularly important aspect of the business of living The posture acquired in early childhood usually remains unchanged throughout the individual's lifetime Whether that posture happens to be good, bad or indifferent, correct or incorrect, is rarely considered, despite the established fact that such consideration would be infinitely rewarding

Many years of activity in orthopaedic practice have revealed that people who continuously—if unconsciously—adopt a slumped posture tend to develop a number of avoidable bodily ills, and are less positive in their approach to life

Eventually, after close study of available data, it became clear that a more dynamic attitude towards the subject of posture would be likely to yield positive results The outcome of this study has been the development and perfection of what has been classified as "Active Alerted Posture", a development implicit with a higher standard of individual and national health and bodily efficiency

Assuming that the principles of Active Alerted Posture have been absorbed, practised and maintained, no bodily action would be contemplated without that body being in a state of complete preparedness The effect of the posture is such as will help reduce accidents in industry and sport by ensuring a greater degree of efficiency and precision in action Moreover, in later life its adoption will contribute to the warding off of the effects of tissue degeneration, besides retarding the osteoarthritis which may ensue from civilian or athletic injuries

Definition of Upright Posture Correct upright posture can be defined as an attitude of the mind towards the body, pro-

moting both mental and physical equilibrium and poise Once its principles have been mastered by constant practice, the various positions can be held unconsciously Little exertion will then be needed to maintain it, there will be no sign of tension and no wasted effort

The Development of the Upright Posture In infancy children lie recumbent, offering no resistance to gravity, but as their pyramidal tracts develop they are able to stand upright Learning to walk is a gradual process, usually preceded by crawl ing By degrees balance improves and a child learns to toddle, taking only a few timorous, experimental steps at the beginning As balance is mastered, standing and walking become a habit

Some children adopt the correct upright posture naturally, others need to be taught it, and ultimately are able to maintain the correct attitude continuously without conscious thought This is ideal, but it is a simple matter for older people also to master the correct upright posture and derive physical benefit as a result

Skeletal Types Obviously everybody is not built in the same way, there is a structural difference in the bone formation of every individual

However, the shape of the skeleton of many people is such that when standing their upright posture assumes a common pattern In this average skeletal type the pelvis inclination is 30° (Fig 1a) and the line of gravity of the body passes vertically through the mastoid process, down through the shoulder joint, in front of the sacro iliac joint, the knee joint, and the ankle joint, but there are variations Wiles (1959), for instance, describes these as due to two components

1 An increase or decrease in the pelvic inclination, or
2 Dorso lumbar kyphosis

These two variables combine to produce four defective skeletal types

(*a*) the lordotic back distinguished by an increase in the pelvic inclination, the dorso lumbar spine being mobile (Fig 1b)

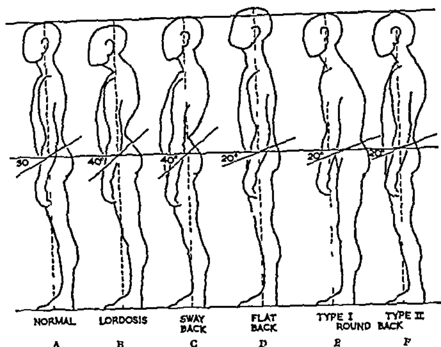


FIG 1
The average skeletal type and four defective skeletal types (After Wiles)

(*b*) The sway back also with an increase in the pelvic inclination, but there is also a dorso lumbar kyphosis (Fig 1c)

(*c*) The flat back there is a decrease in the pelvic inclination, but the dorso lumbar spine is mobile (Fig 1d)

(*d*) The round shouldered back the pelvic inclination is diminished, but there is a dorso lumbar kyphosis (Figs 1e and 1f)

The line of gravity will vary according to the skeletal type

Postural Attitudes Three attitudes to posture, however, can be adopted by any skeletal type, whether it is the average skeletal type, the lordotic back, the flat back, the sway back, or the round shouldered back

These three attitudes cover the positions of the body, whether upright, sitting or lying They are

1 Active Alerted When upright or about to move, an active alerted attitude should always be adopted (Fig 2)

moting both mental and physical equilibrium and poise Once its principles have been mastered by constant practice, the various positions can be held unconsciously Little exertion will then be needed to maintain it, there will be no sign of tension and no wasted effort

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However, the shape of the skeleton of many people is such that when standing their upright posture assumes a common pattern In this average skeletal type the pelvis inclination is 30° (Fig 1a) *and the line of gravity of the body passes vertically through the* mastoid process, down through the shoulder joint, in front of the sacro iliac joint, the knee joint, and the ankle joint, but there are variations Wiles (1959), for instance, describes these as due to two components

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(*a*) the lordotic back distinguished by an increase in the pelvic inclination, the dorso lumbar spine being mobile (Fig 1b)

2 Inactive Slumping This is the normal attitude to posture practised by hundreds of millions of the world's popu lation A slumping inactive posture should never be adopted, either standing, sitting or lying (Fig 3)

3 Passive Supported If at rest, when sitting or lying, the body should be supported by a chair, bed, couch or pillows, with the joints in a neutral position (Fig 4)

In the upright position only 1 or 2 are possible In the sitting or lying positions all three are possible

Skeletal Structures The skeletal structures consist of bones joined together by ligaments, acted on and controlled by muscles, and influenced by gravity under all conditions

To simplify the understanding of the mechanism of Active Alerted Posture, it is proposed to divide the body for practical purposes into a series of mobile sections articulating at five main levels (Fig 5)

1 The Ankle Joint Level the whole body on the ankles and feet

2 The Hip Joint Level the pelvis, trunk, head and upper extremities on the thighs, through the hip joints

3 The Lumbo Sacral Joint Level the trunk, head, neck and upper extremities on the pelvis

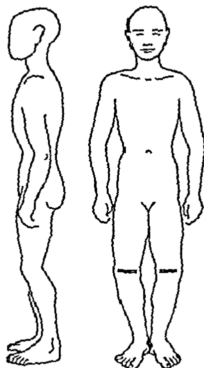
4*a* Occipito Atlantoid Level the head on the neck

b Cervical 5/6 Level

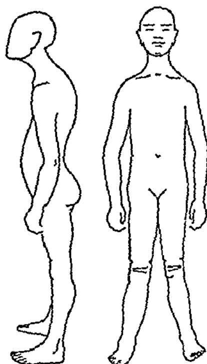
5 The Shoulder Girdle Level the shoulder girdles and arms suspended by muscles from the skull, spine, pelvis and chest wall

Other subsidiary levels such as at the knee and elbow joints could be justifiably included, but to simplify the description, five main levels with mobile sections only are considered Each of these sections is firmly attached to the next at its corresponding articulations by capsular structures and associated muscles

Each section supports the one above it, comparable to the floor levels of a multi storey building, from the foundations to the topmost storey This superficial division is simply made, so that should co ordination in movement break down the point of failure can be localised



ACTIVE ALERTED
FIG 2 Active Alerted Posture in two views



SLUMPING
FIG 3 Inactive Slumping Posture in two views

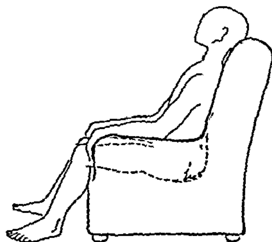


FIG 4 Passive Supported Posture

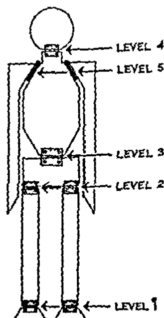


FIG 5 The five main prime fixing levels of the body

hinges are attached by loose screws or are inserted into rotten wood, every time the door is opened strain on the hinges will be produced and eventually the door will fall

Similarly in our own bodies the mobile sections must be firmly attached to the more stable parts, otherwise postural strains must occur, particularly at the five main fixing levels

A more detailed description of the five levels is now given

1 The first level is at the ankle joint and feet Each ankle joint and foot are considered together, as they work in unison The arches of the feet support the whole of the rest of the body, the weight of the body being transmitted through the talus at the ankle joint, to the arches of the feet

2 The second level is at the hip joints Here the pelvis, with the trunk, upper limbs and head, is supported on the head of each femur at the hip joints The weight of the body is trans mitted from the pelvis to the femoral shafts via the head and neck of each femur

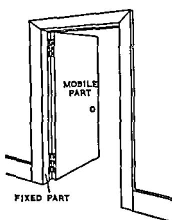
3 The third level is at the lumbo sacral articulations The whole weight of the trunk is transmitted from the vertebral column at the lumbo sacral articulations to the sacrum and thence through the sacro iliac joints to the pelvis The pelvis is greatly thickened, in the area between the sacro iliac joint and the acetabulum, owing to the transference of the body weight

4 The fourth level is where the head joins the neck Pure flexion and extension of the head on the neck, as in nodding, takes place at the occipito atlantoid articulations In normal flexion and extension of the head and neck most of the movement occurs between the fifth and sixth cervical vertebrae

5 Finally, one must consider the attachments of the upper limbs to the trunk by the shoulder girdle This girdle, consisting of the clavicle and the scapula, attaches the limb to the trunk anteriorly by a synovial joint, the sterno clavicular joint In addition, the girdle is fixed to the body by a series of muscles which attach it to the base of the skull above, the iliac crest below, the vertebral column and the thoracic wall

Summary

1 Active Alerted Posture must be practised and perfected in place









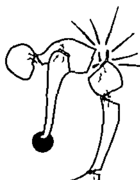


Fig 6 Fig 7

Fig 6 —Upper figure illustrates a door mechanically sound, lower figure one which is unstable

Fig 7 —Upper figures illustrates the right way to lift, lower figure shows the wrong way to lift resulting in an unstable lumbro sacral level

If the mobile sections are not firmly attached at the fixed levels, their weight will act as a gravity pull and exert a strain at their points of attachment This can easily be understood if the component parts of a door be considered by way of com parison A door consists of a mobile section connected by hinges to a fixed frame (Figs 6 and 7) If the door were opened or moved with the hinges unattached the results would be disastrous, as the whole mobile section would probably collapse If the

CHAPTER II

THE ELEMENTARY PRINCIPLES OF MUSCLE PHYSIOLOGY

Voluntary Movement The skeletal muscles are responsible for all voluntary movement A so called voluntary movement, however, is effected more or less automatically once it is learned Even so complex an activity as driving a motor car becomes in time largely automatic or involuntary, only the intent or aim to drive from one place to another remains voluntary The steering-wheel of the car and the foot pedals become extensions of one's hands and feet and driving becomes as automatic as walking

At the outset all co ordinated voluntary activity has to be learned During this period of learning one is at first continually conscious of every individual movement and component of the activity Later one becomes less and less conscious, until eventually, with practice, reflex patterns of great complexity are laid down in the central nervous system At this stage the activity becomes largely automatic, only the intent remains voluntary It is therefore better to consider muscle activity not as wholly voluntary or involuntary, but more or less as a combination of each

In postural activity one is not necessarily conscious of maintaining the position, a good posture can be held, once learned, without conscious effort

The Ways in which Muscles Act

There are several different ways in which muscles can function

1 Prime Movers or Activating Muscles When muscles function as activators they contract and shorten in length (i e concentric action) This results in movement of the joint or joints across which the muscle passes, therefore, for any active

of Inactive Slumping Posture when the individual is upright or about to move As in many cases the habit of correct upright posture develops only with training and practice, it is highly desirable for children to be educated to its benefits as early as possible, so that they can enjoy them throughout their life span

2 Skeletal types depend on the shape of the bony skeleton, variations from the normal account for the lordotic back, the sway back, the flat back and the round-shouldered back

3 For practical purposes the body is divided into mobile parts and fixed parts at five levels

4 The weight of the mobile parts, when not supported by Active Alerted Posture, exerts a gravity strain at the point of junction with the fixed parts

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gravity muscles and actively control the degree of extension of the vertebral column

(c) The antagonists may contract in conjunction with the prime movers This, known as "co contraction", results in a far greater degree of control and smoothness in the movement than if the antagonists relax completely during the movement

3 Synergistic Action When a muscle acts synergistically it contracts but does not change its length, this is described as isometric contraction

Muscles are acting synergistically when they stabilise joints which do not take part in the movement, but which might move as a result of the contraction of the activating muscles This is best illustrated in the action of grasping an object in the hand The wrist joint, which would be flexed by the muscles acting on the fingers, is fixed by the isometric contraction of the extensors of the wrist. A more interesting example is the action of the small muscles round the capsule of the shoulder joint, the "rotator cuff" muscles Their function is to contract synergistically and hold the head of the humerus into the glenoid cavity during movement of the joint Otherwise, in abduction the deltoid would pull the head of the humerus up into contact with the acromion process

4 Fixor Muscles When any voluntary activity occurs that portion of the body which moves may be termed the mobile part The remainder of the body may be defined as the firm base on which the mobile part acts, this base comprising all the remaining segments of the body It is essential that all these segments be stabilised by continuous muscle activity, in order to maintain the part of the body not participating in the voluntary movement in firm dynamic equilibrium Muscles which perform this task again are contracting isometrically and may be termed prime fixing muscles

For example consider the pianist. The activating muscles are those which act on the fingers to produce movement of the keys The muscles of the wrist, elbow and shoulder joints come into action synergistically, so as to place these joints in the best position to carry out the various intricate movements of the fingers in the

movement to occur one or more groups of muscles must contract and function as activating muscles

2 **Antagonists** These are the muscles which could prevent the joint movements produced by the activating muscles, hence the term "antagonistic" Whenever a movement occurs the antagonistic muscle therefore lengthens, and may do so in three ways

(*a*) The antagonistic muscle may relax and lengthen This was shown by Sherrington (1900) to be a reflex relaxation and is known as "reciprocal innervation" For example when the biceps brachii contracts and shortens the elbow joint flexes and the antagonistic muscle, the triceps, reflexly relaxes and lengthens

(*b*) The antagonistic muscle may become active and lengthen (i e eccentric contraction) This occurs when the prime mover acting on the joint is the force of gravity, the antagonistic muscle remains in a state of "contraction" and, as it were, "pays out" and increases its length, so controlling the force of gravity In this case the activating muscles may remain relaxed, their function being taken over by the force of gravity For instance, when the arm is lowered to the side the pectoralis major remains relaxed and its function as the prime mover is taken over by gravity The antagonistic muscle, the deltoid, is contracted but "pays out" and lengthens to allow the arm to be lowered gradually to the side

Antagonistic muscles when acting in this way are termed anti gravity muscles and are contracting eccentrically It is obvious that many of the muscles of the body may at times become anti gravity muscles For example, when bending the trunk forward the prime movers, the abdominal muscles, only start the movement and then relax, as the activating force is really gravity The antagonistic muscles, the erectores spinae, 'contract', pay out and lengthen, and control the flexion of the trunk When full flexion is reached the ligaments of the vertebral column become taut and take over the functions of supporting the body against the force of gravity, the erectores spinae being then relaxed (Floyd and Silver, 1955) Similarly, when bending backwards the erectores spinae now remain relaxed and the abdominal muscles become the anti

gravity muscles and actively control the degree of extension of the vertebral column

(c) The antagonists may contract in conjunction with the prime movers This, known as "co-contraction", results in a far greater degree of control and smoothness in the movement than if the antagonists relax completely during the movement.

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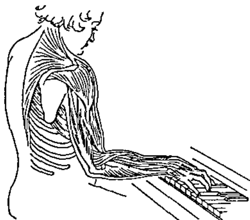


FIG 8

Pianist in the act of playing showing the activating groups of muscles controlling the fingers the synergistic groups controlling the wrist elbow and shoulder joints, and the prime fixor groups controlling the shoulder girdle

most efficient manner These sets of muscles, however, must work on an already alerted base composed of the muscles of the shoulder girdle firmly attaching the whole of the upper extremity to the rest of the body (Fig 8)

Type of Muscle Fibres The fibres of striated muscles are described as of two distinct types, dark red and pale muscle fibres (Adams, Denny Brown and Pearson 1953)

The static or anti gravity muscles show a predominance of red muscle fibres, whilst the muscles concerned with rapid movement show muscle fibres that are mainly white

In man, however, all muscles have a varying amount of red and white muscle fibres, and it is not possible to distinguish muscles composed entirely of either one class of fibre or the other If the explanation of the function of red and white muscle fibres is correct, this forms a structural correlation of the fact that all muscles can act both as fixating and as activating muscles

The picture is further complicated by the recent work of Eccles and his co workers (1960) on fast and slow muscles

The Nervous Control of Muscle In general, muscles are controlled by two sets of motor neurones, the upper motor neurones and the lower motor neurones In addition all muscles have an afferent nerve supply

1 THE UPPER MOTOR NEURONE extends from a cell in the motor cortex of the brain down through the internal capsule and the brain stem, crossing over at the junction between the brain stem and the spinal cord, then passing down the cord as the crossed corticospinal tract Each neurone ends by forming a synapse with a motor cell in the anterior horn of the spinal cord Thus the right side of the body is controlled by the left cerebral cortex

2 THE LOWER MOTOR NEURONE originates as a cell in the anterior horn of grey matter in the spinal cord, or the cranial equivalent in the case of the cranial motor nerves, the nerve fibre passing out in the anterior root into the spinal nerve, and then through the appropriate peripheral nerves to the group of fibres it supplies within the muscle

Damage to the upper motor neurone results in a characteristic paralysis, with increase in muscle tone, increased reflexes, and little muscular wasting

A lesion of the lower motor neurone results in a paralysis, marked by a complete loss of muscle tone and reflexes and marked muscle wasting

It should be emphasized that it is movements and not individual muscles which are represented in the cerebral cortex

3 THE SENSORY NERVE SUPPLY OF MUSCLE In addition to the motor supply all muscles have a sensory nerve supply, and comprise up to 50% of the fibres in any so called motor nerve These sensory fibres supply structures, called muscle spindles, lying in the long axis of the muscle between the muscle fibres They function as stretch receptors, are stimulated by increasing the length of a muscle and send back "information" to the brain, i e proprioceptive information concerning the length of the muscle It is these receptors which are stimulated when a muscle jerk is elicited and which form the sensory component of the tendon reflexes

The muscle spindle, in addition to its sensory supply has its own motor supply These motor nerves to the spindles form about 30% of the fibres in the anterior root of a spinal nerve, and are known as the gamma efferent fibres The remaining 70%

of the motor fibres, known as the alpha efferent fibres, form the motor supply to the muscle fibres at the motor end plates

The gamma fibres in the peripheral nerves are distinguished by their small size and are also referred to as the small motor nerve fibres

The function of the gamma fibres is that of regulating the sensitivity of the spindles during muscle activity, so providing a feed back or servo mechanisms The muscle spindle with its motor and sensory nerve supply is the peripheral part of a reflex mechanism, operating through the spinal cord, which helps to regulate muscle activity in posture and movement

Damage to the sensory nerves, e g cutting the posterior roots or in tabes dorsalis, results in a break of the reflex arc, resulting in a loss of muscle tone and absent reflexes

It is essential that these sensory and motor nerves controlling the activity of the muscles should function normally

The Blood Supply of Muscle The circulation of the blood and body fluids is intricately interwoven with muscular action and its blood supply It has been demonstrated that muscles have a rich blood supply and there is an extensive vascular bed present At rest the capillary bed largely closes down and blood passes from the arteries to the venules through numerous arterio venous shunts With any increase in activity due to the local formation of metabolites, this reserve vascular bed opens up and more and more capillaries come into use

This provides an efficient mechanism to control the volume of blood flowing through the muscle, operating according to need, providing an adequate blood supply to actively metabolising and functioning muscle

During maximum contraction, the circulation through the muscle can be arrested, due to the direct compression of the blood vessels by the contracting muscle, but, provided such contraction is less than maximal, there is a continuous blood flow through the muscle during the process of contraction (Barcroft and Swan, 1953)

During rhythmic contractions, providing each contraction is moderate in intensity, there is a free hyperaemia and a con

tinuous blood flow through the muscle If, however, the rhythmic contractions are very strong, the blood flows through the muscle in spurts, its progress being obstructed during the strong contractions and free through the widely dilated vessels during relaxation

For muscles to function normally adequate nutritive material and oxygen must be provided, and waste products removed This is the function of the circulatory system

In addition to the circulation through the closed cardiovascular system, there is also circulation in the extravascular compartment of the body, which consists both of the fluid within the cells, the intracellular fluid, and the fluid in the spaces between the cells, the extracellular fluid

As the return of the blood, lymph and tissue fluids to the heart depends largely on muscle activity, it is not out of place at this stage to describe the accepted modern conception of their circulation

Franklin (1951), giving a comprehensive description of the present views on the circulation, said "The blood circulation itself is but a part of the vast continuous movement of the body fluids as a whole, a movement by means of which even the cell constituents are constantly being removed and replaced so that no individual remains exactly the same from hour to hour or even minute to minute The simple conception of the blood being pumped from the heart through the great arteries to the distant arterioles and capillaries and then returning through venules and veins to the right auricle has given way gradually to the realisation that a complete conception of the circulation embraces the tissue fluid, lymphatic circulation and intra and extracellular changes"

Gamble (1947) has shown that 70%of the body weight is made up of water (Fig 9)

Many factors regulate and influence the distribution and composition of the body fluids in the three compartments, namely

1 The vascular { (*a*) arterial
(*b*) venous
(*c*) lymphatic

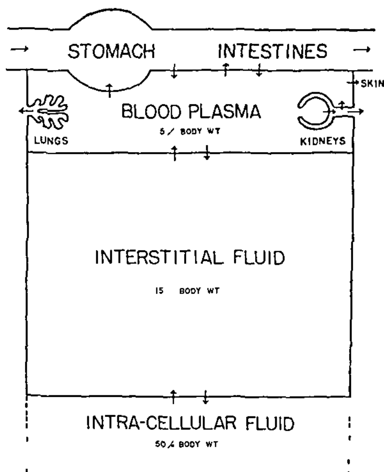


Fig 9
Distribution of fluid in the body

2 Extracellular
3 Intracellular

The total volume depends on the intake and output of fluids, thus adjustments by the circulatory, respiratory and renal systems are continually taking place Additional control is exerted by the nervous system and the endocrine glands

The interchange of materials from the capillary to the cell occurs by means of those fluids across the interstitial spaces, this being the immediate environment of the cell The exchange is determined by

1 The barriers between them, *i e* the capillary and cell walls

2 The effective hydrostatic pressure in the capillary

3 The effective osmotic pressure

The capillary wall acts as a selective semi permeable membrane, permitting passage of water, ions and simple organic solids Proteins and other large molecules penetrate with great difficulty The effective hydrostatic pressure is the differential between the capillary and the tissue pressure This results from the pumping action of the heart tending to drive fluid out of the arterial end of the capillary, and the counterforce provided by the resistance of the tissues and the pumping action of the muscles

The effective osmotic pressure is dependent on the chemical composition of the blood and tissue fluids Due to the high concentration of protein in the blood the major osmotic contraction is into the lumen of the capillary Electrolytes moving freely across the capillary wall, drawing water with them, modify this effect

Summary

The different types of muscle fibres, their action, nerve supply and nutrition, have been discussed, but this is but a small part of the mechanism of the body, as muscular activity producing superb balance will naturally depend also on the whole intricate integration of the functions of the heart, lungs and brain

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CHAPTER III

THE ELEMENTARY PRINCIPLES OF THE MECHANICS OF POSTURE

Sir Isaac Newton was the first scientist to appreciate the laws of gravity and to realise that the earth's forces effected a pull on all objects, including man For any object to remain stable the line of gravity must fall within the area of its base, or contact with the ground In man, the line of gravity must, therefore, fall within the area outlined by the feet when standing without support

Symmetrical and Asymmetrical Standing (Fig 10)

When standing symmetrically, the line of gravity will run exactly between the two feet, each foot bearing half the weight of the body But, as with the leaning Tower of Pisa, man may also stand asymmetrically, with most of the weight of the body borne by one foot only, the other helping to maintain balance In such case the line of gravity now runs through the foot bearing the weight of the body instead of between the feet

When standing still in a bus queue or talking in the street, Smith (1954) found that people stood asymmetrically four times as often as symmetrically Each stance is held on the average for about 30 seconds, and not longer than one minute before changing to another position (This study was made without the subjects knowing they were being observed, one of the problems being that if the subject realised he was under observation he would tend to change or modify his stance)

When standing in one of these positions, whether symmetrical or asymmetrical, there is always a small degree of sway movement forwards and backwards, called "movement on a stationary base" (Hellebrandt, 1938) The body is never absolutely immobile except for a few moments at a time

The Effect of Gravity on the Body

The body is not a rigid object, but consists of a series of unstable joints which unite its segments The force of gravity acts on all the joints of the body, and the effect of gravity on each joint must depend on the relationship of the line of gravity of the body to the joint For example, if one stands with the line of

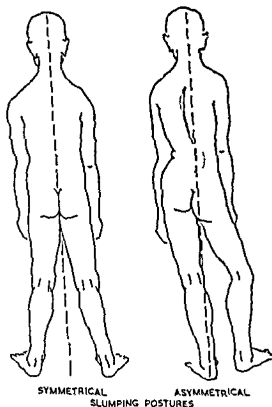


FIG 10
Symmetrical and asymmetrical standing

gravity in front of the ankle joint (as normally happens) gravity will tend to pull the body forward at the ankle joint If, however, one leans back so that the line of gravity now falls behind the joint, gravity will pull one backwards at this joint

The Importance of Muscles and Ligaments in Standing

If the individual is to remain upright, with the centre of gravity within the area outlined by the feet, the joints of the body,

from the arches of the feet to the skull on the atlas, must be stabilised by the activity of the muscles which counteract the pull of gravity This muscular activity is assisted to a varying degree by the passive tension of the capsule and ligaments of the joints, and also by the deep fascia around them

As the joints of the lower limbs are not at the extreme limit of movement when standing upright, the part played by the joint capsule and ligaments in maintaining posture should not be im portant However, there is evidence to show that the capsular structures and the deep fascia of the lower limb can both play a part in maintaining posture, even though the joints are not at the extreme of movement (Smith, J W , 1957)

The Degree of Muscle Activity in Standing

It has long been known that the amount of muscle activity in posture may vary considerably, it being possible to maintain an upright position with little muscular activity This posture, known as Inactive Slumping Posture, is detrimental to the individual's well being and should be replaced by a more dynamic attitude—Active Alerted Posture

Before each joint level is considered in turn, a short account of the principles of muscle action and joint mechanics will be given

Mechanics of Joints

LEVERAGE AND EQUILIBRIUM Stabilisation of a joint is a matter of equilibrium between two forces (Steindler, 1955) For equilibrium to occur at any joint a balance must exist between the groups of muscles around that joint If only a single muscle group acts it must produce a turning effect at the joint, and unless counterbalanced by an equal and opposite force, will induce a movement at the joint as opposed to equilibrium

In this way the maintenance of the upright posture depends on a balance between the opposing groups of muscles round each joint The muscles are then contracting without shortening (isometric contraction)

However, it is possible for equilibrium to be produced with only one muscle group contracting when the opposing force is gravity In this case the balance lies between two opposite forces, the one being gravity and the other, muscle activity

Finally, it is possible for equilibrium to occur at a joint without any muscle action whatever In this case there is a balance between the force of gravity on one side, and tension in ligaments on the other For example it is possible to stand with the line of the centre of gravity in front of the knee joint, and with the muscle groups round the joint relaxed, this indicating a balance between the force of gravity acting in front of the joint and the tension in both the capsule and deep fascia behind the joint. The ham strings and quadriceps muscles can both be completely relaxed, provided the centre of gravity is not too far in front of the joint If, however, the arms are raised forwards, such movement shifts the centre of gravity still more anterior to the knee joint, and the hamstring muscles then contract to aid the capsule in maintaining equilibrium at the joint (Joseph and Nightingale, 1954)

When the two forces are on opposite sides of the joint, the result affords an example of a lever of the first order On the other hand, when the two opposing forces are on the identical side of the joint, and therefore are attached to the same lever arm, they

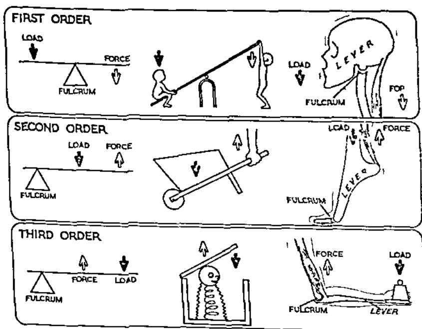


FIG 11
The different orders of lever action in the body

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2 SECOND ORDER OF LEVERS Standing on "up toe" is an excellent example of this order The fulcrum is the ball of the foot The load and the force are both on the same side of the fulcrum, the load coming between the fulcrum and the force The load is represented by the weight of the body, and the force is the activity of the calf muscles lifting the body upwards

3 THIRD ORDER OF LEVERS Holding a weight in the hand is an example of this order The force and the weight, or load, are both on the same side of the fulcrum, which is the elbow joint The force is represented by the activity in the flexors of the elbow, and comes between the fulcrum and the load in the hand

Certain basic principles in the mechanics of posture as applied to normal posture, but which we contend is Inactive Slumping Posture, will now be described

When standing upright one tends to adopt one of two attitudes

(a) Symmetrical standing, when the line of gravity of the body falls equally between the two feet

(b) Asymmetrical standing, when most of the body weight is taken by one or other foot This attitude is four times as common as the symmetrical

These positions are seldom maintained for more than a minute at most (on the average for thirty seconds), when a change is made to another attitude Standing, then, is defined as a series of static attitudes punctuated by movement to change the pose

During each phase of the standing position there is never absolute immobility Continuous slight forward and backward swaying movements occur, mainly at the ankle joint, "movement on a stationary base" (Hellebrandt, 1938)

The maintenance of posture depends to a greater or lesser extent, on two factors the activity of the muscles, and the tension in the capsule and fascia round each joint, which maintain them in a state of dynamic equilibrium against the opposing forces of gravity

The idea based on the classical work of Sherrington and Magnus that the postural muscles are all in a continuous state of reflex activity should be modified Postural muscles can relax completely when passive forces in the ligaments are avail

are enabled to maintain equilibrium by acting in opposite directions These are examples of the second or third order of levers, depending on which force is considered the primary force and which the resisting force When the load or resisting force is nearer the joint, this is a second order of levers When the load is farther from the joint than the primary force, this is a lever of the third order

Examples of all three orders of levers are found in the body (Fig 11)

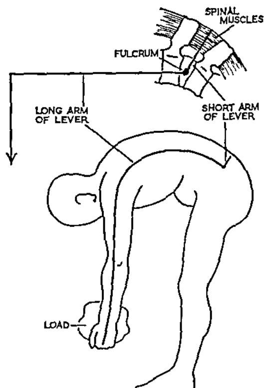


FIG 12
Equilibrium at the lumbo sacral joint

1 FIRST ORDER OF LEVERS Equilibrium at the lumbo sacral joint is an example of this The fulcrum is the lumbo sacral disc, the weight or load is the force of gravity acting on the trunk, head and upper limbs The opposing force is the activity of the trunk muscles, the erectores spinae when the trunk is bending forwards, or the rectus abdominis when the trunk is bending backwards (Fig 12)

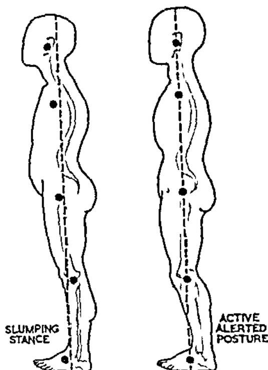


FIG 13 FIG 14

FIG 13—Line of gravity in Inactive Slumping Posture
FIG 14—Line of gravity in Active Alerted Posture

symmetrical position From below upwards the line passes in front of the ankle joint and just in front of the knee joint, behind the hip joint, in front of the sacro iliac joint and through the second piece of the sacrum The relationship of this line to the vertebral column is more variable depending on the pelvic inclination and passes up through the lumbar vertebrae, in front of the thoracic vertebrae, through the cervical vertebrae and finally to the mastoid process of the skull The line usually passes through the centre of the shoulder joint

The factors maintaining posture at each level are now considered in turn, and are based on many recent studies, using the electromyogram as an index of muscle activity In Active Alerted Posture (Fig 14) the line of gravity falls through hip and knee joints and further in front of the ankle joint than in slumping posture, so that in the former the individual is standing more

able and strong enough to take over the task of supporting or counterbalancing the force of gravity

The idea that the ligaments and surrounding fascia of a joint are completely inextensible, *i e* that they only become taut at the extreme limit of movement of a joint, should be modified in view of recent investigations into the passive mechanisms which stabilise joints The fully extended position of a joint is not an absolute and limiting position Passive tensions arise in and around the joint before the ultimate limit of movement occurs (particularly at the knee joint) and can play a major role in supporting the body against the force of gravity, even though the joint is not at the limit of movement (Fig 16)

The Problem of Pain in Stretched Ligaments One argument always used to refute the idea that ligaments play a part in maintaining posture, is that taut ligaments so often become painful as, for example, the pain behind the knees after resting the heels on a railway carriage seat However, this does not arise until at least half a minute has elapsed

Recalling that the act of standing involves a series of attitudes lasting for an average of half a minute, the attitude then being changed to a different position, this continuous alteration in pose would never allow the ligaments to be stretched long enough to become painful before the tension is relieved

Possibly the reason for the frequent change of attitude is that after thirty seconds or more the ligaments do in fact begin to become stretched, but this is appreciated first at a "subconscious level" the attitude is reflexly changed, and so relieves the tension before one becomes conscious of any painful sensation

In patients with "congenital absence of pain" this mechanism would not work, and so might explain why their weight bearing joints may become progressively disorganised, as in a Charcot's joint Such patients, apart from *insensitiveness to pain, have a* normal nervous system

The Centre of Gravity of the Body

In a slumping posture the relationship of the line of gravity of the body to each joint is shown in Fig 13 when standing in a

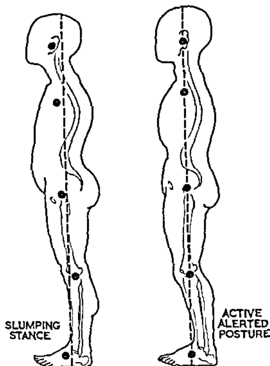


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forwards on his toes rather than, as in the latter, backwards on his heels (Fig 13)

The Lower Limb

The Ankle Joint Because the line of gravity runs in front of the ankle joint during standing, gravity tends to carry the body forward at this joint

This tendency is resisted both by the activity of the calf muscles and also by the passive tension in the soft tissues behind the joint The postural activity of the calf muscles is a continuous, although fluctuating, activity and is at least twice as great as the passive tension in the soft tissues (Smith, 1957)

As would be expected, the anterior tibial muscles show no active to stabilise the ankle joint

As has been already observed, during the attitude of standing there is a continual slight swaying movement forwards and backwards, occurring at the ankle joint The line of gravity of the body always remains in front of the ankle joint during this swaying, the movement being controlled by the continual but fluctuating activity in the calf muscles (Fig 15)

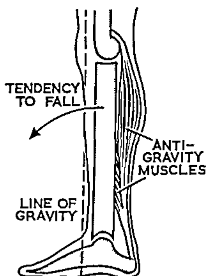


Fig 15
Equilibrium at the ankle joint

The Feet Half the body weight is supported by each foot in symmetrical standing, the weight being borne by the arches of the feet The pressure is taken up by the heel and the outer border of the foot Each foot may be considered as a half dome, with the heel, outer side of the sole, and the toes all in contact with the ground, and the inner side, the medial longitudinal arch, raised

When standing at ease the body weight tends to be taken more by the heel than the ball of the foot, the subject showing a ten

dency to stand with his weight back on his heels The factors which stabilise the foot in standing have been argued over for many years, but they are due to a combination of passive tensions in the ligaments and soft tissues and the postural activity of the muscles which control the arches The disagreement arises over the relative importance of these two mechanisms However, there

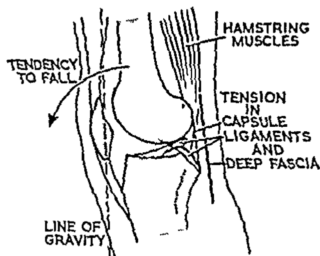


FIG 16
Equilibrium at the knee joint

is little doubt that in the easy standing positions (Inactive Slumping Posture) the weight of the body can be borne by the feet without appreciable muscle activity, and that the medial arch is maintained largely by the passive tension in both the capsule of the joints, particularly in the spring ligament and the soft tissues in the sole of the foot (Smith, 1954)

The Knee Joint In the easy standing position (Inactive Slumping Posture) the line of gravity passes just in front of the knee joint Gravity tends to pull the body forward at this joint and to hyperextend the joint This force can be controlled to a great extent by passive factors, partly tensions in the ligaments of the joint, and partly tension in the soft tissues and the deep fascia behind the joint (Fig 16) These passive factors are enough to counteract the force of gravity that tends to pull the body forward

(Joseph and Nightingale, 1954, Smith, 1956) The quadriceps muscle remains relaxed (unless the line of gravity is shifted back wards, for example, by holding the arms behind the body), and the hamstring muscles either remain relaxed or show a very low grade intermittent activity Should the arms be held forward, the line of gravity is shifted further forward, the turning force on the knee joint is increased and the hamstrings then contract However, this is probably to control the hip rather than the knee joint These observations apply to both standing symmetrically and asymmetrically with the body weight taken by one leg

The Hip Joint In the easy standing position (Inactive Slumping Posture) the line of gravity falls behind the hip joint (Akerblom, 1948) In this position the joint is not fully extended, the force of gravity is thus tending to extend and so turn the body backwards at this joint The muscle group that would normally stabilise the joint is the ileo psoas muscle, and it might be expected that this muscle would show a continuous activity during easy standing A recent investigation by Joseph and Williams (1957) has shown that it is possible to stand upright with complete absence of activity in any of the muscle groups round the hip joint, including the ileo psoas muscle In this case, although the hip joint is not fully extended, passive tension in the capsule (the ileo femoral ligament) and the deep fascia, similar in nature to that described by Smith for the knee joint, could be expected to stabilise the joint against the force of gravity

The Trunk

Wiles (1959) has emphasized that the posture of the vertebral column and its antero posterior curves is influenced by the pelvic inclination, which depends on the "set' of the pelvis at the hip joints Any increase or decrease of the normal pelvic inclination is compensated for by an increase or decrease of the lumbar curvature (Fig 1)

An increase in the pelvic inclination results in an increase of the lumbar curve (lumbar lordosis), a decrease resulting in a flattening of the lumber curve In this way the line of gravity of the body is kept in a constant position in relationship to the ankle joints and the feet

The Sacro-iliac Joint The line of gravity passes through the second sacral vertebra in front of the axis of the sacro iliac joint The force of gravity tends to impel the sacrum not only down wards but to rotate it forwards The joint is stabilised by a most perfect osseous and ligamentous locking mechanism, and for practical purposes no movement occurs at the sacro iliac joint (Gray, 1958)

The Vertebral Column The line of gravity of the body passes through the lumbar vertebrae, in front of the thoracic vertebrae and through the cervical vertebrae Most of the move ments occur at the lumbo sacral joint and between the lower lumbar vertebrae

The vertebral column is normally in a state of balanced equili brium The joints are in an intermediate position and are not controlled by tension in their ligaments Because, however, the column is in a state of balanced equilibrium, little muscular activity is required to maintain its posture, and if the head is suitably "adjusted" complete relaxation of the erector spinae can occur for short periods of a few seconds' duration

Normally, in the at ease position the force of gravity tends to flex the vertebral column As a result the erectores spinae show a continuous low grade activity in most subjects studied This activity is a fluctuating one, due to the normal forward and back-ward sway of the body already described, and is accentuated by closing the eyes The abdominal muscles remain slack However, if the sway is deliberately increased, the abdominal muscles contract to control and correct the backward sway, and the erectores spinae contract more strongly to control the increased forward movement (Floyd and Silver, 1955)

FLEXION—RELAXATION OF THE ERECTOR SPINAE When the subject bends forward and the vertebral column is flexed, this movement is finally limited and checked by the tension in the vertebral ligaments This tension is strong enough to counter balance the force of gravity, and at this stage of full flexion the erector spinae relaxes completely The vertebral column is now stabilised entirely by tension in its ligaments unsupported by any muscular activity (Floyd and Silver, 1955)

This capacity of the spine to be stabilised in flexion by tensions in its ligaments without muscle activity is, therefore, another example of the way in which passive tensions in ligaments and other tissues are able to counterbalance the turning force of gravity in the place of muscle activity

THE EFFECT OF WEIGHT LIFTING When standing erect and balanced the force of any weight held by the arms is borne directly by the lumbar vertebrae For example, if 100 lbs are held, the force acting through the lumbo sacral joint is 100 lbs plus the weight of the head and upper limbs and trunk above the sacrum

When the trunk is flexed, the weight held by the arms now acts as a force flexing the vertebral column, and is counter balanced by the contraction of the erectores spinae The fulcrum is the lumbo sacral disc The erectores spinae are acting about two inches behind this fulcrum, and the weight in the arms may be about 30 inches in front of the fulcrum If the burden is 100 lbs the force exerted by the erector spinae must be fifteen times the weight held in the hands, *i e* 1,500 lbs The load on the disc is therefore 1,600 lbs plus the weight of the trunk, in all a total weight of nearly a ton (Bradford and Spurling, 1945)

When lifting a heavy load it is therefore essential to keep the trunk erect, hence the dictum, "It is better to bend the knees than to bend the back" (*Fig* 17)

There is evidence that the lumbar vertebrae are crushed and broken when forces of more than 1,000 lbs are transmitted through them (Virgin, 1951)

It is therefore likely that when heavy weights are involved, there is an additional mechanism wherewith to supplement the efforts of the erectores spinae in supporting the vertebral column It seems possible that, by contracting and raising the intra abdominal pressure, the anterior abdominal muscles play an important role in this support Bartelink (1957) has suggested that the positive pressure in the abdominal cavity (when the abdominal muscles are contracted) acts like an inflated rugby football fixed in the pelvis, which supports the vertebral column, assisting the efforts of the erectores spinae (*Fig* 18)

The Head on the Neck The position of the head and neck

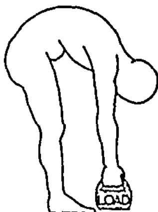


Fig 17
The right way and the wrong way to lift weights



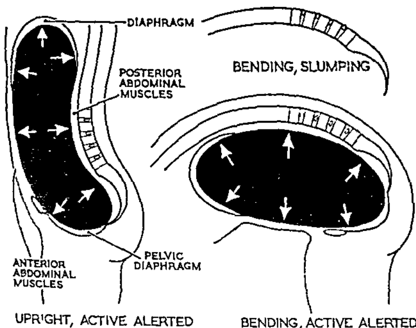


Fig 18

This illustrates the contraction of the abdominal muscles in Active Alerted Posture In bending the abdominal muscles carry out this movement, actively contracting The contractions of the abdominal muscles are like an inflated football and support the spine

The inset above shows in bending when the posture is Inactive Slumping the fronts of the discs are compressed, with the tendency for the nucleus pulposus to be pushed back towards the spinal column (After Bartelink)

is so variable and so bound up with the temperament and per sonality of the individual that no simple description can be given All that need be adduced is that a state of continual unstable equilibrium exists and the posture is controlled by the activity of both the post vertebral and the pre vertebral muscles

The Shoulder Girdle and Arm The upper limb is attached to the trunk partly by a bony strut, the clavicle This is strongly attached to the sternum at the sterno clavicular joint, at which movements occur during any activity of the shoulder girdle In addition, the girdle is suspended by a number of muscles, par ticularly the trapezius, serratus anterior and the levator scapulae which run from the trunk to the scapula and the clavicle The upper limb is thus supported by two mechanisms

1 The passive tension in the ligaments of the sterno clavicular joint
2 The postural action of the muscles

Detailed studies have yet to be made, but it is likely that the upper limb could be supported by ligaments of the sterno clavicular joint with little or no muscular activity, apart from their passive tension In a preliminary study it was found that the upper fibres of the trapezius were inactive in almost all subjects studied while standing at ease (J G Bearn, personal communication)

Conclusions and Summary

These studies all show that the upright posture can be and probably in many people is maintained remarkably with little muscle activity except for the continuous activity of the calf muscle to stabilise the ankle joint and a low grade activity of the erector spinae to maintain the posture of the spine

All other muscle groups may be largely without muscle tone and only come into activity to control larger postural swaying movements In this posture the joints of the body are not in a perfect balanced position because the line of gravity is either in front or behind each joint This means that the weight of the body must be counterbalanced to a large extent by passive tension in the joint tissues

As a result of this

Firstly, if stress on the supporting tissues exceeds a certain limit, damage may result which will become progressive over the years

Secondly, and perhaps more important still, abnormal shocks or strains are transmitted directly to the joint, and the inactive or poorly contracting muscles afford little protection This is well illustrated in lumbar spinae in the flexed position, which is then far more vulnerable to injuries owing to the relaxation of the erectores spinae, as well as to the long leverage action

Thirdly, this posture must delay or retard recovery from any injury to the joint, as the stresses of gravity will fall directly on the recovering joint tissues once the muscle spasm following the damage has disappeared.

Fourthly, it is concluded that a more dynamic posture is essential This posture is called Active Alerted Posture

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grade muscle activity controlling the normal postural sway of the body

We have to recognise Inactive Slumping Posture as the upright posture commonly adopted by hundreds of millions of humans, and it will be seen that it is this which causes conditions of postural strain A detailed description of this posture is now given (Figs 3 and 13)

Inactive Slumping Posture

1 **The Feet** are everted and the arches of the foot are maintained by the ligaments with only occasional activity of the muscles controlling the arches

2 **The Ankle Joint** As the centre of gravity of the body is in front of this joint, activity is continuous in the calf muscles to check the body from falling forward The anterior tibial muscles are relaxed (Fig 15)

3 **The Knee Joint** The centre of gravity lies just in front of the joint and is stabilised by the cruciate, collateral and posterior oblique ligaments Intermittent activity in the hamstring is just sufficient to control the continual postural sway of the body (Fig 16)

4 **The Hip Joint** The centre of gravity lies just behind the hip joint, and the joint is stabilised by the iliofemoral ligament The ilio psoas, gluteal and hamstring muscles all show minimal activity at intervals sufficient only to control postural sway (Fig 13)

5 **The Lumbo-sacral Joint and the Vertebral Column** Very little activity occurs in the erectores spinae or the abdominal muscles, although, alternating activity of these muscles controls the postural swaying of the body

6 **The Head/Neck Level** The head tends to drop forwards or sideways, pivoting on the neck The upright position must be maintained by slight contraction of the posterior cervical muscles, which are a continuation of the erectores spinae muscles in the lumbar region

7 **The Shoulder Girdles** All muscles supporting the shoulder girdle, *i e* the trapezius, the levator scapules and the serratus anterior, are inactive and the shoulder girdle droops

CHAPTER IV

POSTURAL ATTITUDES

ACTIVE ALERTED POSTURE

Attitudes towards posture are a mental process Active Alerted Posture is a positive one, whereas Inactive Slumping Posture is negative Either one or the other posture must be adopted by the individual when in the upright position The benefits that accrue from practising Active Alerted Posture are so obvious that a widespread acceptance of this principle would seem to be essential

Plato has said that the most beautiful motion is that which gives the maximum result with the minimum effort The trained athlete, for example, does not appear to expend any extraordinary energy in performing the most difficult of feats The beginner, essaying to perform the identical action, lacks the co ordination of movement of the trained man and so may fail to complete the action or, in doing so, may sustain an injury

All recent studies with electromyographic recordings from the postural muscles have shown that what is usually known as the normal upright posture is an unstable posture, with continuous slight swaying movements For brief periods of a few seconds the upright posture is maintained in an insecure balanced position with remarkably little activity in any muscle group, with the exception of the calf muscles and the erectores spinae These short periods of inactivity fluctuate with short intervals of low grade muscle activity, in which various muscle groups contract to control the normal slight postural sway of the body arising from the action of gravity For example, when the body tends to sway forward the extensors of the trunk and the hamstrings contract as anti gravity muscles, their function being to restore the body to the upright position Similarly, if the body tends to sway backwards, the flexors of the trunk, *i e* the abdominal muscles, the anterior crural muscles and the quadriceps must contract again as anti gravity muscles to restore the body to the upright balanced position

Thus, so called normal posture (Inactive Slumping) can be maintained to a large extent passively with short periods of low

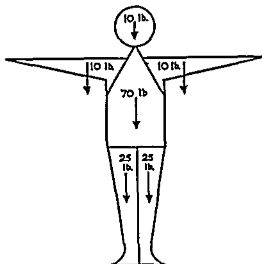


FIG 19
The distribution of weight in a human body weighing 150 lbs

In cases of Inactive Slumping Posture the weight of these various segments of the body frequently acts as a deadweight on the more stable fixed parts, especially at the five prime fixing levels already described

In Active Alerted Posture all the prime fixing muscles are alerted so that the various postural levels described are fixed or held firm by muscle action This is the protective position of readiness which primitive man or animals adopt in preparation for flight or fight From this state of Active Alerted Posture at rest, activating movement can be initiated without pause or strain on the joints

Active Alerted Posture

This posture, as applied to the various sections, will now be described

1 The Entire Body on the Feet and Ankles

The firm, resilient support of the human frame stems from ability to stand firmly on both feet, with the joints of the feet and ankles stabilised by muscle action, like a house built on a solid foundation of rock, with the stress and strain from above

The human foot has two functions to perform—the static or supporting function at rest and the dynamic function during movement

downwards and forwards There may be resulting tension on the vascular structures and the roots of the cervical and brachial plexuses through approximation of the first rib to the clavicle

The individual who passively submits himself to this "inactive slumping" posture may be compared to a motor car with flat tyres, a condition imposing much greater strain than normal on the rims of the wheels, the chassis and the springs

All active movement should be based on a background of muscle activity It follows, therefore, that any movement that aims to correct Inactive Slumping Posture should involve activation of the prime fixing muscles at the outset In other words, to employ a homely analogy, the "slumper" must first pump up the tyres before attempting to drive the car away

More important still, in this Inactive Slumping Posture the various postural levels are "off guard" in terms of muscle activity Therefore any sudden strain or injury thrown on the joint must involve the capsular ligaments directly, the relaxed muscles affording no protection against such mishaps

Associated with Inactive Slumping Posture are certain movements employing gravity as the activating force, so that the antagonistic group of muscles countering the effects of gravity work eccentrically by contracting and lengthening, as, for example, when lowering the arm to the side and when bending the trunk forwards In Inactive Slumping Posture, with gravity allowing the arm to drop to the side, there is no contraction of the pectorals, but the deltoid contracts eccentrically Contrary to this, in Active Alerted Posture, when the arm is brought to the side, there is an active contraction of the pectorals and a balance between them and the deltoid

Here are some figures that speak for themselves In an individual weighing 150 lbs the distribution of weight has been given as follows (Fig 19)

Trunk and Pelvis	70 lbs
Head	10 lbs
Upper extremities (10 lbs each)	20 lbs
Lower extremities (25 lbs each)	50 lbs
	150 lbs

foot, pressing inwards against the ground to form an inverted Gothic arch (Fig 20) It was Mensendieck who stressed the importance of the weight on the outer side of both feet, so that the line of the forces of strain followed the gentle curves of a parabola meeting at a point some twelve inches below the ground

2 The Pelvis on the Hip Joints

The fixation of the pelvis on the hip must be maintained by a balanced contraction of the flexors and extensors of the hip on the one hand, and the abductors and adductors on the other Trueta (1953) and Denham (1959) have shown that the femoral head can be compared to a nut inside a nut cracker The femoral head is subjected to compression in hyperextension of the thigh by the long lever of the femoral shaft and the anterior ligament plus the front of the acetabulum When, however, there is a balanced contraction of the muscles and the joint is held actively in slight flexion, this "nut cracker" effect is diminished Contraction of the glutei is the essential factor in standing actively alerted, with the other muscles surrounding the joint falling into balanced contraction The glutei should contract so firmly and hard that a coin can be held between the natal cleft

3 The Trunk on the Pelvis

Although in the slumped posture it is possible to maintain the trunk in the upright position with remarkably little muscular activity, in Active Alerted Posture there must be a balanced contraction of all the abdominal muscles with a balanced contraction of the erectores spinae

In Active Alerted Posture, flexion of the spine at the lumbo sacral joint is performed by active contraction of the abdominal muscles, the erectores spinae working as an active antagonist (co contraction) throughout the entire movement

The contracted abdominal muscles act as a buffer or break to flexion Thus, a wall of contracting muscle cushions down any ill effects that follow flexion on the spine, particularly on the fronts of the intervertebral discs (Fig 18)

It is important to remember that in Active Alerted Posture a slight active flexion position should be adopted to decrease the

In the static phase the weight of the body is taken evenly on the heel and *the outer side of the foot, the toes are brought* into the action of standing so that pressure is taken off the heads of the metatarsals Each foot has been likened to a half dome, the two feet together forming a complete one (Jones, 1944) The inner longitudinal arch of each foot is maintained by the contraction of the anterior and posterior tibial muscles and the long flexors of the toes At the same time the toes grip the ground by the action of the short flexors and intrinsic muscles The knee joint, held very slightly flexed, is stabilised by the balanced contraction of *all* the muscles, the quadriceps, the hamstrings, the abductors and adductors of the thigh This position of feet and knees is taught to the parachutist for the purpose of enabling him to land smoothly and avoid injury

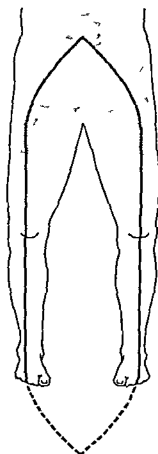


Fig 20

Weight on the outer side of foot, with pressure against the ground the inverted Gothic arch.

In the so called normal foot posture, with the feet in flat valgus position, an abduction opening strain is produced on the inner side of the knee, whereas in *Active Alerted Posture* a slight adduction compressing force is produced, closing the articular surface of the femur and tibia together on the inner side of the knee This effect is beneficial, allowing the line of gravity to pass through the centre of the knee joint

In the applied mechanics of house construction use is made of two forces of stress meeting at a point, for example, as in a Gothic arch one side supports the other Thus in Active Alerted Posture the body weight should be taken on the outer side of the

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lumbar curve and straighten the back, with the buttock muscles contracted and tucked under A neutral position is then estab lished in which no strain is imposed on any one particular verte bral structure

Certain authorities are agreed that many ordinary backaches are avoided or relieved by the same quite simple measure of maintaining an accentuated lumbar curve They advise, when standing, sticking out the buttocks backwards, bracing back the shoulders, and tightening up the back muscles, even if this experiment does involve a protruding stomach

This simple procedure may be helpful likewise in the acute phase of a disc episode At such a time the patient often adopts a protective bent forward position with a tilt to one side, known as "sciatic scoliosis", which Steindler (1954) described as "the antalgic position" This is the position which the patient can adopt to accommodate an inflamed or degenerated structure such as a prolapsed disc Should this posture be maintained overlong, however, it is imposing a stress on the posterior intervertebral or apophyseal joints, which in time become osteoarthritic It is therefore essential to return as soon as possible to Active Alerted Posture

4 The Head on the Neck

The head could fall in any position unless maintained upright by balanced muscle contraction Magnus and Sherrington have postulated that the head and neck position exerts a con trolling reflex action on the entire body The chin must be kept well tucked in and the back of the neck is stretched so that the person stands to his full height

5 The Shoulder Girdles

There must be a fixation of the shoulder girdles by continuous muscle activity so as to oppose the downward sagging force of gravity In the slumped posture the various muscles supporting the girdle are relaxed, and the limb sags with the strain on the components of the cervical brachial plexus and the sub clavian vessels

In Active Alerted Posture the upper limbs must be held slightly elevated and, if anything, slightly forward, ensuring balanced contraction between the trapezeii, levator angulae scapulae, the scalenes, rhomboids and the serrati This prevents compression of the nerve components and the great vessels between the clavicle and first rib

If the person who has become used to standing in the Inactive Slumping Posture is to master the Active Alerted alternative he must make a continuous effort to maintain it Eventually, with constant repetition, most people are able to train themselves to hold this posture without fatigue and ultimately without any conscious effort They then discover themselves in a constant state of dynamic equilibrium and are able to pass from Active Alerted Posture at rest into smooth and efficient action

This active posture when finally perfected keeps the whole body when upright in a continual state of being "on guard", and so helps to prevent accidents and minimise injuries

The importance of relaxed posture is stressed by physical culture experts throughout the world Relaxed posture is that which has been described in this work as Active Alerted Posture—truly relaxed, in that it uses the minimum of muscle activity to maintain the body in a state of dynamic equilibrium

One frequently hears it declared that an athlete or ballerina in action was "beautifully relaxed" This does not mean that they were slumping inactively, but rather that they were actively alerted with perfect poise and balance, so that each muscle group was in correct balanced co contraction

Active Alerted Posture is in fact relaxed posture The prime fixing levels are fixed by just sufficient muscular activity to hold each muscle group balanced against its antagonistic group In running, this allows the activator groups to work continuously with the minimum formation of waste products

Passive Supported Posture (Figs 4 and 21)

It is obvious that it would be impossible for the individual to maintain Active Alerted Posture indefinitely, although it is true that the more practised one becomes in this attitude the longer time it is possible to hold the alerted positions

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Summary

1 In the upright position two attitudes to posture can be adopted

(*a*) Inactive Slumping Posture
(*b*) Active Alerted Posture

These are described in detail

2 At rest, sitting or lying, Passive Supported Posture is ideal
This also is described in detail

3 Perfect movement depends largely on exact timing in the contraction of the appropriate groups of muscles—the prime fixors, the synergists and the activators Only when practising Active Alerted Posture can this precision of timing be achieved, with Inactive Slumping Posture balance can indeed be maintained with remarkably little muscular activity, but no account is taken of the strain which the weight of the mobile parts imposes on the fixed parts

4 Relaxed posture should be applied to Active Alerted Posture because the movements are executed with the minimum of effort and expenditure of energy on a base around which the muscles are in perfect equilibrium This means that the base is firmly fixed by balanced co contraction of each muscle group

5 Passive Supported Posture is also relaxed posture, but then the body is at rest, with the joints in a neutral position

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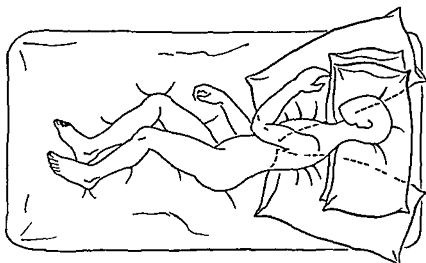


FIG 21
Passive Supported Posture, lying with the joints in a neutral position

When resting completely relaxed on a bed, with the dead weight of all the mobile parts adequately supported in a neutral position, the postural attitude is said to be Passive Supported While on the bed, however, unconscious movements in all directions must take place from time to time so as to change position Thus while resting in Passive Supported Posture it is imperative for the bed to be firm and supporting, with the pillows so arranged as to keep the head in a central neutral position This applies also to the other fixing levels (Fig 21)

This kind of support is ideal so long as the individual remains at rest, but it is important that before any upright movement is initiated, Active Alerted Posture be adopted in order to avoid a possible strain or sprain To change from Passive Supported to Active Alerted Posture the prime fixing groups of muscle must be contracted Should a too rapid movement be made direct from Passive Supported Posture without this preliminary fixing of the muscles, a strain is liable to occur

athlete "winds himself up", during which time the point of balance is constantly altering its position Finally, just before the ball is released, forward movement is checked for a moment, the action being completed on a firm rigid base, with the result that the recoil and resulting force is maximum In this action there is thus a constant and continuous flow of movement until the movement is suddenly and abruptly checked

In jumping in the line out at rugby football, or in heading the ball the player runs the risk of knee injury unless he lands on his feet in the correct way (on the outer side of the forefoot) gradually sinking on to the heels, so that eventually the landing foot becomes firmly fixed on the ground and the body weight evenly distributed over the whole of the outer weight bearing part of the foot By this means there is a stable base on which, by the balancing actions of the controlling muscles, the knees can bend slightly but remain under firm co ordinated muscle control This prevents any abnormal strain being thrown on the ligaments of the joint, particularly on its inner side

In an England v Wales Twickenham match some years ago, a player tore a left hamstring muscle, the injury keeping him out of the first half He came back in the second half and, still very lame, was asked to convert a try on the touch line He failed to do this although his action had been perfect He had placed his left fixing foot in line with the ball, but when the activators of his right leg began to work he could not produce the firm stabilising fixing power in his left leg, which gives distance, because his left hamstrings were torn and painful Of course, he should never have been given the kick (Fig 22)

Another example of the effects of unco ordinated movement is shown in the case of two international fast bowlers who sustained identical injuries on the same day, namely, a tear of the left abdominal obliques at their costal attachments The first bowler, seen in the morning, stated that when he was about to deliver the ball his left foot, the forward fixing foot, slipped The other bowler, seen in the afternoon, explained that he had mis timed his action and delivered the ball before his front left foot was firmly fixed on the ground In both cases an activating movement

CHAPTER V

THE ANALYSIS OF MOVEMENT AND THE EFFECTS OF BAD POSTURE

In the case of a patient accustomed to Inactive Slumping Posture a sudden movement may often produce an acute strain of muscles or sprain of a joint A latent morbidity may also exist in the muscles and joints as the result of Inactive Slumping Posture Any aggravation of this by reason of an injury may produce physical signs and symptoms out of all proportion to the severity of such injury Although this may be a surmise, a careful consideration of the history of the injury, physical signs and symptoms and the patient's present attitude to posture, make this impression tenable

Athletic feats are being surpassed year by year, the superb records of athletes from many countries suggesting that methods of training are rapidly approaching perfection It may well be that in the near future the athletic world will align itself with the modern trend by developing muscular efficiency still more intensively To bring this about, athletes must possess a working knowledge of the physiology and mechanics of muscle action and its application to posture and movement and they must be familiarised with the art of movement under the study of kinesiology This deals with the breaking up of an action into its component parts, and its relation to the various types of lever action Such division into separate phases of movement has also been described as the anatomy, or analysis, of movement

In the act of moving from one leg to another, the muscles of the foot on the ground are braced and contracted from the moment of impact, remaining so until the activators of that leg have driven the body forward From the moment it leaves the ground there should be abeyance of all muscular activity in that leg, until the muscles of the other leg have activated and the first leg again becomes the fixing one

In such actions as bowling at cricket or pitching at baseball the

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In such actions as bowling at cricket or pitching at baseball the

movement which prevents injuries can only be developed by appreciating these general principles

So much depends on active alerted muscle action and this, associated with an alert state of mind, can go a long way in the prevention of many athletic and countless road accidents If children were educated in the advantages of Active Alerted Posture by the time they were ten years old, from then onwards they would be prepared for action, their attitude of mind towards posture would develop into a habit so ingrained that they would automatically tend to become accident proof

We have defined postural strain as the dead weight of the mobile parts on the muscles and joints associated with the fixed parts In Inactive Slumping Posture the pumping action of the muscles which constitutes the peripheral venous heart, is less efficient The return to the heart of venous blood, lymph and tissue fluid is less complete, this resulting in accumulation of fluid in the extremities, particularly the lower limbs This is well recognised in some people who sit for a prolonged period with their feet down, as for instance on an overnight journey in a train or aeroplane, when oedema of the legs may occur If the sciatic nerve is involved in an injury there may be oedema of the limb, partly due to the loss of vasomotor activity in the blood vessels, but also to the slowing down of the pumping action of the muscles on the venous and lymphatic circulations

A further example of the effects of loss of muscle activity is seen in patients who have been confined to bed during a prolonged illness They may show marked swelling of the legs on getting up, until vasomotor activity in the muscles has returned

In occupational and postural strains the antigravity muscles become fatigued and strained and show areas of spasm This makes them painful and tender They lose their resilience, become inefficient, and no longer adequately support their underlying joints These in turn suffer from strain, and eventually develop degenerative changes

A number of histological studies have been made on these tender muscles, and their supporting and overlying tissues, but in most cases these have shown no abnormality Electromyo

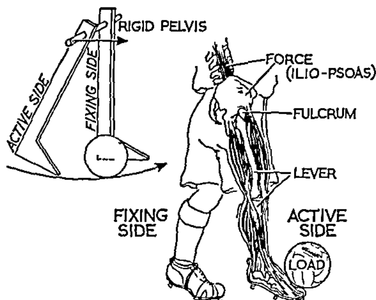


FIG 22
This illustrates that the footballer in the act of kicking must place the fixing foot exactly in line with the ball so that the load, the force and the point of lever are one above the other

had taken place on an unstable base, thus throwing a strain on the left abdominal obliques These should have already been contracted before the activating movement with the arm had commenced

A wrist joint affected by a recent injury or arthritis will often give rise to pain on sudden movement because the wrist joint itself takes part in the activating movement If, however, the joint is firmly locked by the contracting of the wrist joint fixing muscles, and the prime fixing level is transferred from the shoulder girdle level to that of the wrist joint itself, laxity and play between the joint surface are prevented The same effective movement can now be carried out without pain by means of the fingers working on a stable base, the wrist joint

There are numerous examples of lack in appreciation of the essentials of muscle action Balance and perfect co ordination of

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graphic studies of these muscles have disclosed the presence of small scattered areas of spasm It is well known that muscle in spasm is painful and tender to palpation

Two explanations of this muscle spasm are possible One, that the spasm is produced by nerve root irritation from the adjacent strained spinal joints The second theory is that the muscle is fatigued, with an accumulation also of metabolites in the muscle

Whichever explanation is accepted, it must be recognised that poor posture is usually the initial factor in bringing about this muscular tenderness This syndrome has been variously called fibrositis, muscular rheumatism or myalgia

Ideally, histochemical studies are correlated with studies of function, so that a comprehensive investigation has three dimensions function, chemical composition and structure

Depending upon the pathogenesis of the condition, it is frequently possible to detect alterations in the first two, before any change in structure would be revealed by conventional histopathological methods This implies that modern histochemical techniques permit earlier detection of abnormalities while still only functional or chemical changes have occurred and no structural changes are demonstrable

From experience gained in the examination of thousands of cases, the impression is that in the early stages of postural strain something accumulates in the tissues, resulting in pain and tenderness As there are no structural changes at this stage, the condition can be checked, the tenderness of the muscles made to disappear, and a complete cure made possible

Changes in the Capsular Ligaments of the Joints

At the present time the degenerative changes denoting wear and tear occur first of all in the articular cartilage However, this assumption may be due to the fact that it is not until articular cartilage erosion occurs, that the patient s symptoms are sufficiently severe to warrant operative investigation If, however, an operation is necessary and the condition of the joint has progressed to the stage of cartilage erosion, there are also changes in the synovial membrane and the joint capsule Therefore, as the result of postural strain changes can occur in the capsule and

synovia of joints, resulting in pain and tenderness in these struc and may even lead to an effusion into the joint cavity

Changes in Cartilage and Bone

At first, changes in the articular cartilage, and later in the subchondral bone, probably occur after the soft tissue changes Priority of the commencement of pathological changes has been given to these structures over the soft tissues, but this is a de batable point It is suggested that postural strain evokes bio chemical changes in the muscles, and if these are not treated further changes occur in the capsule, synovia and articular cartilages of the joints

Once changes in the joint structures have occurred the muscles may be further involved by a reflex protective spasm This spasm functions as a protective mechanism to guard the joint from further strain The spasm may involve a single group of muscles on one side of the joint, as in sciatic scoliosis If the joint changes are more general, all the muscles around the joint may go into spasm

Muscle pain and tenderness may therefore occur at three distinct phases firstly in the early stages of postural strain as a local accumulation of abnormal metabolites in the muscles secondly, at a later stage when the joint tissues themselves become involved, as a painful protective spasm of the muscles which may occur either suddenly or gradually and finally, when osteo arthritis has supervened as tender, painful fibrotic degenerative changes in the muscles surrounding the joint involved

It has been postulated that bad posture and postural strain lead up to a series of biochemical and structural changes which terminate in osteoarthritis There are, of course, many other factors which may predispose the joint to osteoarthritis These include injury, sepsis, toxins—bacterial or metabolic—throm bosis of the vessels around the joint, and even constitutional hereditary factors These are some of the contributory conditions which play an important part in the production of joint degener- ation, but chronic postural strain, resulting from bad posture, can affect people of any age and is a factor which should have far

wider consideration from the public at large This point was expressed by Goldthwait as far back as 1915

The detrimental effects of bad posture on muscles and joints at various postural levels are now given (Fig 23)

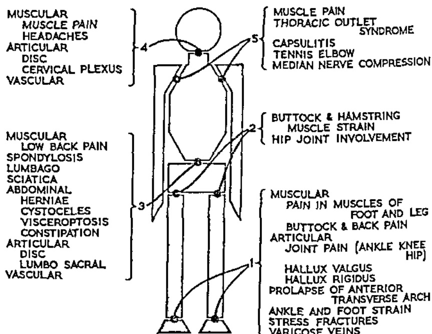


FIG 23
The effects of postural strain at the five main fixing levels

1 At the First Level the Ankles and Feet There are a multitude of conditions associated with chronic foot strain due to bad posture Postural strain may cause aching and pain in all the muscles of the leg and foot Postural strain likewise affects the longitudinal and transverse arches of the foot, and is a factor in the development of hallux valgus, hallux rigidus, clawing of the toes, stress fractures of the metatarsal bones, the lower end of the fibula and even the tibia, plantar fasciitis, the onset of osteo arthritic changes in the ankle and sub taloid joints, and strains of the tendo achilles which may even lead to rupture of this tendon

The effect of incorrect ankle and foot posture leads to buttock and low back pain, for the reason that the components of the joints at these levels endeavour to adjust themselves to the con

dition of foot strain, and in time show signs of strain themselves High heels tend to throw the weight of the body forward, and produce various types of metatarsalgia with clawing of the toes and in some cases contraction and shortening of the calf muscles It should be noted that people with varicose veins frequently have poor ankle and foot posture, and there can be no doubt that slumping posture has a direct bearing on the onset of this affliction

The habitual flat foot produces indirectly a strain on the inner side of the knee, resulting in tenderness over the medial collateral ligament, particularly in middle age It is sometimes associated with chondromalacia patellae and early osteoarthritis of the knee joint in the relatively youthful patient

The everted flat foot places a strain on the adductor group of muscles, and results in the wrong positioning of the head of the femur in the acetabulum Over the years this can develop into an important factor in the production of osteoarthritis of the hip joint

2 At the Second Level the Pelvis on the Two Hip Joints Various pains can occur round the hip joint, usually at the origin or insertion of the glutei or at the origin of the hamstrings and the adductor group of muscles This may result in pain on movement, tender areas over the various muscles and restriction of hip joint movements, eventually leading to osteoarthritis

3 At the Third Level the Lumbo-sacral Joint Many disabilities at the lumbo sacral level may be accounted for by poor posture These include chronic low back pain, spondylosis with lumbago and even sciatica There may be various muscle pains and tenderness in the erectores spinae and the glutei as well as the complications of atonic abdominal musculature, giving rise to hernia, cystoceles, visceroptosis and constipation

4 At the Fourth Level the Head on the Neck and Trunk Pain in the muscles controlling the position of the head on the neck and trunk may occur as a result of wrong posture This results in tenderness of the cervical muscles and both localised pain and referred pain to the scalp associated with occipital

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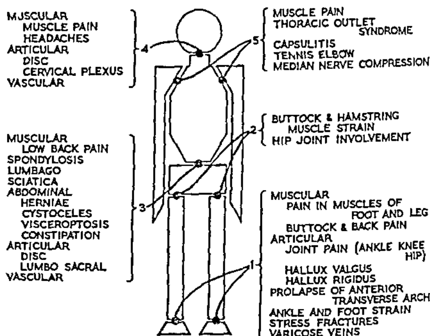


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CHAPTER VI

THE PRACTICAL APPLICATION OF ACTIVE ALERTED POSTURE

Rudolph Magnus (1926) said that "posture is an active process, and is the result of a great number of reflexes, many of which have a tonic character "

Like most things, however, Active Alerted Posture can be expected to confer its maximum benefits only on those who are prepared to practise it assiduously It is useless to adopt it for a few seconds each hour, it must be practised until it becomes a continuous process Once this has been achieved good posture becomes almost a natural reflex and Inactive Slumping Posture feels wrong Even the person naturally gifted with good balance can enhance its benefits by constant and conscious practice of Active Alerted Posture

Stress and Strain Hans Selye (1950) has postulated his stress syndrome, and at the present time hundreds of medical articles are appearing presenting the theme of the stress and strain of everyday life on various organs of the body Within the last few years Dr Wilfred Barlow's contributions (1955 and 1959) have been particularly valuable

Waiters, policemen and many members of the medical profession, to name only a few of the working millions, slump at their work, standing on flat valgus feet with a tendency to knock-knees The abdomen is often pendulous and the back hollow, with the shoulder girdles drooping and the head pushed forward

It would be ridiculous to claim that every disease of the body and every symptom of stress and strain stem from faulty posture The medical profession as a whole, however, must become conscious of the great benefits accruing from an alerted, dynamic attitude to posture, must recognise how frequently the processes of physical wear and tear, and their outward signs and symptoms, disappear once Active Alerted Posture has been mastered

headaches As well as headaches, stiffness of the neck, creaking on movement and giddiness are sometimes predominant symptoms Even cerebral symptoms, with loss of memory and inability to orientate, may in time develop

5 **At the Fifth Level the Shoulder Girdle** At this level the symptoms may be those of pain in the muscles supporting the shoulder girdle, particularly the trapezius, levator scapulae, the rhomboids and the serratus anterior In mild cases there are early symptoms of a thoracic outlet syndrome including mild degree of tennis elbow, golfing elbow, numbness and tingling, "pins and needles"

Degenerative changes in the cervical spine may occur with advancing age *Pain in the neck and upper limb may be caused* by disc degeneration, arthritis of the joints of Luschka and root cuff fibrosis Any one of these may produce a brachial neuritis, sometimes with agonizing pain which may be referred down the limb as far as the hands

There may be a feeling of swelling of the hands, wrist and forearm, median nerve compression in the carpal tunnel, and various pains in relation to the shoulder joint itself The capsule of the shoulder joint may be involved, particularly the long head of biceps brachii and the supraspinatus tendon Gradually a painful capsulitis of the shoulder joint develops into a "frozen shoulder"

Summary

1 Faulty posture in motion is likely to account for acute traumatic conditions and inefficiency at work and play

2 Postural strain is considered in relation to its effects on the circulation

3 An explanation of fibrositis is given as a biochemical change in the connective tissues of the muscles

4 The development of changes in joint structures and ultimate osteoarthritic changes is described as a result of bad posture

5 The five postural levels are considered and the disorders caused by incorrect posture are discussed

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Many doctors who have had backache themselves have volunteered the information that since practising "Active Alerted Posture" their pain has either disappeared completely or become bearable

The medical practitioner owes it to himself to practise alerted posture and be in a position to expound the simple principles of body mechanics to his patients He must become steeped in the benefits to be derived from the combination of the right application of actions, of a body so positioned that these actions can be produced with maximum effect and minimum effort Only when Active Alerted Posture has become part of his own personal way of life, can he appreciate the reasons for adopting this common sense principle He must understand that it takes time and considerable repetition before he can expect it to become ingrained as a habit Exercises practised half heartedly, without thought and without understanding of their eventual aim, will accomplish no healthful purpose

This was recently illustrated in the case of a boy of twelve with flat valgus feet His mother complained that although he had been carrying out prescribed exercises for eight years he still had flat feet It transpired that he had indeed been doing the exercises regularly, but in a half hearted fashion without relating them to correct foot posture, and without putting them into practice in his daily life when walking or standing He was then given precise instructions for carrying out the exercises, and in order to help him form a habit he was asked to write out the correct method of standing every day for a month At the end of the month he was standing correctly

It is almost an axiom that if certain feats are to be performed perfectly the individual must be prepared to give considerable thought to their execution, must practise them methodically and frequently The pianist, the acrobat, the ballerina and every type of athlete must practise his or her speciality for hours each day before becoming proficient Furthermore, there must be an intense application of the mind until the execution of the actions becomes automatic and perfect For example, it is recorded that a woman born without arms was able to carry out all the sewing

for her family of six children The intrinsic muscles of her feet were developed to so fine a degree that she could thread a needle with her toes She was able to accomplish this only by sheer necessity and after considerable persistence and practice

Present day athletes train by three methods, firstly, weight lifting, secondly, circuit training, and thirdly, the method adopted by the great runner Alfred Shrubbs, *i e* alternating running and walking a certain distance The mile runner will train by running a fast $\frac{1}{4}$ mile and then a slow $\frac{1}{4}$ mile alternately He increases the speed of the slow quarter gradually until he can perform each quarter in about the same time

All exercises in these three methods are designed to improve the static as well as the dynamic muscle fibres Weight lifting is particularly beneficial for the development of the static muscles, and even now the sprinter trains by the lifting of light weights, compared to the weight lifter or the shot putter who practises with heavy weights Both are developing their static prime fixor muscles in different ways for different uses Previously it was thought that excessive exercise produced a condition of staleness However, it has been proved that continuous repetition is as beneficial to the powers of endurance as to muscle efficiency

Emotional Strain Many hundreds of hospital patients are reported as suffering from psychosomatic complaints, or those simply labelled "functional disability" It will be noted that many of these cases improve if the principles of an Active Alerted Attitude to posture and body mechanics are explained to them and they agree to carry them out

Provided the breakdown in the somatic element is corrected, the psyche will often look after itself On the other hand an emotional disturbance can be the beginning of a slumped posture, the slumping posture then gives rise to physical tensions When these are relieved through correct posture, an emotional relief very often follows Physical tension and emotion each plays its part, depending on the patient and his illness, sometimes the one, and sometimes the other may be primary Like the age old argument of the chicken and the egg, it is often difficult to assess which has been the initial cause

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at an early date, especially if the actions form part of his everyday work or occupation Great strides have been made in industry in the devising of appropriate instruments, so that when used the principles of good body mechanics are applied, thereby removing stresses and strains from the workers' muscles and joints

Who is to be entrusted with this enormous and strenuous task of bringing home to everybody in the world the benefits of Active Alerted Posture? It must be the task of the medical profession and, as previously suggested, the general practitioner must be able to expound its principles and benefits, as well as those of simple body mechanics However, as correct locomotion and body mechanics are thoroughly understood by orthopaedic surgeons, doctors of physical medicine, neurologists and the auxiliary personnel such as the physiotherapist and the physical training instructor, it should be their special responsibility also to teach Active Alerted Posture to the rank and file

It has been found by experience that roughly one out of five people who are taught Active Alerted Posture and the elementary principles of body mechanics during the course of a disability, persevere with the posture and apply it seriously throughout life Two out of five will practise it while under treatment, but the other two consider the effort, mentally and physically, too great and do nothing more about it

Many patients complain that it is impossible to walk standing on the outer side of the feet, gripping with the toes To these it can be explained that there are two functions of the feet, the static and dynamic, comparable to those of a bow and arrow The Active Alerted ankle and foot, held braced with the toes gripping the floor and the weight on the outer side, can be likened to the tense bow A person proceeding into motion is then like an arrow shot from this bow Obviously there is not the same resistance and recoil in an action initiated by a person standing on flat feet (Fig 3)

Others find it impossible to draw the abdominal muscles in at the same time as making an active movement They claim that it is not possible to talk or walk with these muscles contracted firmly However, with practice it is possible, as it happens to be

The psychologist will no doubt frown on this concept of functional or psychosomatic medicine, but in many cases the breakdown originates with the strain of muscles and joints from postural causes and faulty body mechanics, and then the mind will suffer in consequence

This point was stressed forcibly in the case of a lady of sixty seen several years ago She was a farmer's wife, cooked for eighteen in her household, and in her spare time gave violin lessons to children in the village When examined at hospital she appeared to be suffering from symptoms related to a cervical and dorsal spondylosis, associated with a brachial neuritis and a capsulitis of the shoulder As infrequent physiotherapy failed to produce alleviation and her mental state appeared to be deteriorating, she had been subjected to electro convulsion therapy, with no improvement whatsoever With rest, a plastic collar, attention to posture and body mechanics, and adequate physiotherapy she became in time almost symptom free No doubt each one of the above methods of treatment contributed to her improvement, as each was dependent on the other

There are many notable figures in the medical profession who have for years taught the benefits accruing from correct posture and proper body mechanics A few of those of the past were P H Ling, C Sherrington, R Magnus, A Keith, B M Mensendieck, and A Steindler Special mention should be made of J E Goldthwait, who, at the age of 94, is still himself practising the correct upright posture which he has been teaching over the last sixty years

Of present day orthopaedic surgeons I should like to mention but a single name, that of Dr M Beckett Howorth of Stanford, Connecticut, who has produced a superb film on Dynamic Posture His ideas on Posture would appear to be similar to those held by the writer

Occupation Obviously the occupation of the individual will also affect muscles and joints If an individual's posture is an Inactive Slumping one at rest, when actions follow they are frequently performed mechanically, and incorrectly There will be evidence of stress and strain in the muscles and joints, often

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the acquired posture of the singer and that of the mannequin and the champion road walker

When walking in this manner has been mastered the individual progresses in a state of perfectly synchronised bodily movement The head, neck and trunk with the pelvis are held together firmly, as the upper arm of the lever The fulcrum or lever passes through the hip joints and progression is accomplished in a forward direction as each leg thrusts forward and pivots from the hip joints Side swaying and trunk rolling are eliminated

Unless and until the individual learns to talk and breathe at the same time as holding the abdominal muscles up and against the posterior abdominal wall, Active Alerted Posture has not been mastered The individual learns to use the accessory thoracic and shoulder girdle breathing muscles and therefore breathes properly, fully expanding the lung bases which so often in the normal individual are never properly aerated This section of the body which is taken up by the lower dorsal spinal muscles and base of the lung is a relatively immobile part, and has been named by the writer "the no man's land of the body" It is here that so many chest conditions originate as the result of improper breathing, especially after an operation

Active Alerted Posture, in which a person becomes conscious of his every action, can indeed form the basis for a new conception of life The individual learns to appreciate everything that is happening around him, in learning to alert himself he becomes more aware of the needs of others Mentally this leads to a more altruistic approach to living

It can be seen that the sooner Active Alerted Posture is more widely appreciated and practised, the better As previously suggested, children should be steeped in its benefits at an early age This done, they tend to avoid hurting themselves, become less accident prone, perform their actions mechanically more correctly and suffer less from the stresses and strains of life Most children around the age of ten have their heroes the girl perhaps, a great ballerina or a reigning beauty, the boy a famous athlete The suggestion that they in due time might emulate their

idols by developing Active Alerted Posture would provide the exciting incentive

The story is told of a distinguished motorist who, driving along an arterial road at 100 m p h suddenly applied his brakes, coming to an abrupt halt at the junction of a country lane To the amazement of his companion a farm worker on a bicycle emerged from the lane, and rode straight across the arterial road But for the motorist's amazing sense of awareness the cyclist would most certainly have been killed

On being asked what had led him to anticipate a possible casualty, the motorist explained that having noticed the birds rising from the hedges as he was approaching the lane, he assumed that someone was preparing to cross the arterial road His superb sense of anticipation in this instance certainly saved a human life Subconsciously, perhaps, our motorist must have been practising Active Alerted Posture, profiting by the sense of anticipation, of preparedness the posture impresses on the mind

It cannot be too frequently stressed that once an individual has learned Active Alerted Posture, a slumping inactive posture will *feel* wrong, it will be considered in the light of a sacrilege to continue it He will adjust himself automatically to correct posture and its benefits will help him throughout his lifetime

No person should undergo an operation for an unstable joint before mastering Active Alerted Posture and the mechanics of movement, for it is possible that he may be able himself to control the instability of the joint by appropriate balanced action of the muscles If, however, an operation is necessary, which often may be the case, the balanced muscular activity will help the operation and prevent strain on neighbouring joints This is particularly important in the case of spinal injury, as a stabilising operation at one level may produce such strain at another that a repetition of symptoms is liable to occur

It is not suggested that the patient should become, as it were, fanatical about Active Alerted Posture There is no need to become a muscle man or a hypochondriac obsessed by the workings of the human body It is the object of this book to bring to the

notice of the medical profession the benefits accruing to perfect posture and the mechanics of muscular action

It is suggested that an instructional film on Active Alerted Posture might appropriately—and fruitfully—be sponsored by authorities responsible for health, education, transport and labour

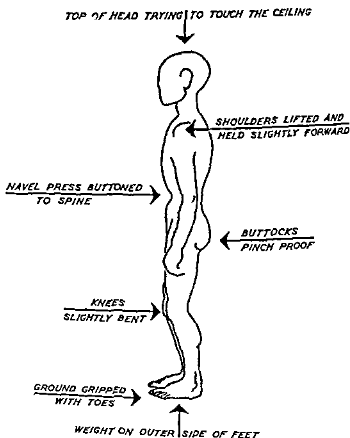


FIG 24
This illustrates the various positions of the body in perfect Active Alerted Posture

The medical profession must accept the fact that throughout life certain muscles suffer from the ordinary processes of wear and tear, that the amount of wear and tear is far greater in those who slump and adopt an inactive slovenly attitude to posture than in those who continuously practise an active alerted approach. Muscle strain must lead in time to joint strain, with the subse

quent tendency to osteoarthritis, particularly of weight bearing joints, and to spondylosis of the spine, with disc degeneration and osteoarthritis In the outpatient department of every hospital throughout the world, thousands of patients attend because fundamentally and primarily they are suffering from the effects of a slovenly, slumping attitude to posture

Summary

1 The instructor in Active Alerted Posture should constantly remind his pupils of the various correct positions He must bring home to them the vital principle that by standing actively alerted the pupil is locking the mobile sections firmly to the more stable parts

2 He illustrates to his pupil how he must stand firmly on the outer side of the feet, gripping the floor with his toes and bending the knees slightly at the same time This affords a firm base on which to move, and the knee joints are protected from direct strain by the balanced contractions of all the muscles controlling these joints

3 The buttock muscles are held firm, with the abdomen muscles drawn up and in This fixes the pelvis firmly at the hip joints below and to the trunk above

4 The shoulder girdles are elevated slightly and held forward, if anything, the back of the neck is stretched as long as possible, thus removing tension and strain from the head, neck and shoulder girdle levels

5 Remedial exercises are essential to strengthen muscles which are weakened by faulty posture, injury or disease

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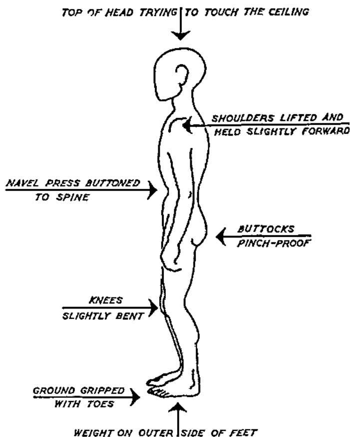


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